Passive Technology to Improve Criticality Control of NTP Reactors, Phase I

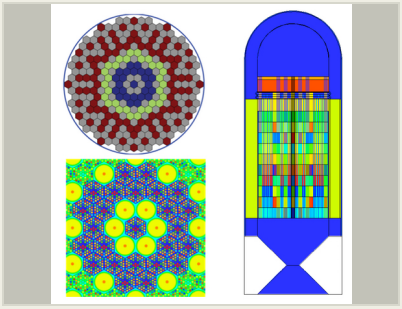
Completed Technology Project (2015 - 2015)

Project Introduction

The objective of this SBIR is to investigate passive technology that will enable criticality control of a Nuclear Thermal Propulsion (NTP) reactor during a burn with little to no mechanical movement of the circumferential control drums. Specifically, this work will study passive reactor design features that mitigate and counteract the effects of 135Xe, the dominant fission product contributing to reactivity transients in a moderated NTP reactor. Examples of passive reactor design features to be studied include tuning temperature reactivity feedback mechanisms, employing burnable poisons, and suppressing the build-up of 135Xe. By minimizing or eliminating the need for mechanical movement of the circumferential control drums during a NTP burn, the passive technology studied in this SBIR will greatly simplify controlling a NTP reactor and increase the overall performance of the NTP system.

Anticipated Benefits

The proposed technology will be crucial for the successful implementation of thermal spectrum NTP systems, specifically LEU fueled NTP systems. They can also be applied to other space nuclear systems for power production. The technology proposed here would enable not only the extension of core lifetimes without having control systems with a large reactivity worth, but will also be able to suppress fluctuations in reactivity. This will allow the use of automated systems to manage and operate nuclear power systems in support of NASA missions to other planetary bodies, asteroids, or space stations where there is a need for large amounts of power and an absence of sunlight or other energy sources to supply it.While these systems are being designed for NTPs, the knowledge gained and systems developed can also be applied to terrestrial systems. Specifically, this technology can be applied to terrestrial nuclear systems that need to be small and compact and have to operate in remote locations for extended periods of time where increased reliability throughout the reactor's lifetime is necessary.



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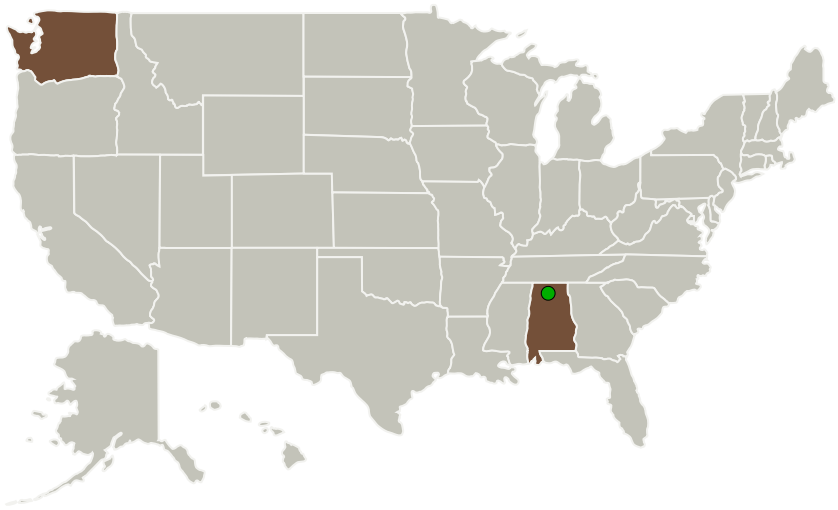
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Ultra Safe Nuclear Corporation	Lead Organization	Industry	Seattle, Washington
Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	Washington

Project Transitions

June 2015: Project Start

December 2015: Closed out

Closeout Summary: Passive Technology to Improve Criticality Control of NTP R eactors, Phase I Project Image

Closeout Documentation:

- Final Summary Chart Image*(https://techport.nasa.gov/file/139205)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Ultra Safe Nuclear Corporation

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Project Managers:

Bill Emrich
Gwenevere L Jasper

Principal Investigator:

Paolo F Venneri

Co-Investigator:

Paolo Venneri

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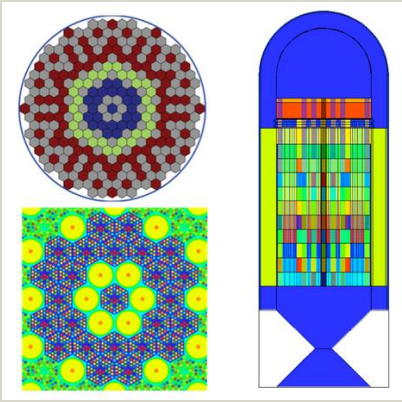
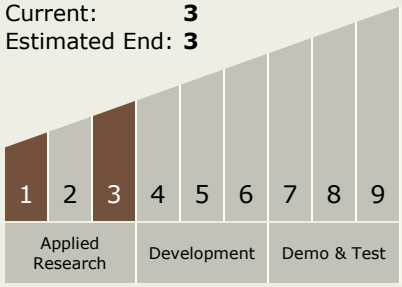
Images



Briefing Chart Image
Passive Technology to Improve Criticality Control of NTP Reactors, Phase I
(https://techport.nasa.gov/image/133446)

Technology Maturity (TRL)

Start: **1**
Current: **3**
Estimated End: **3**



Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System